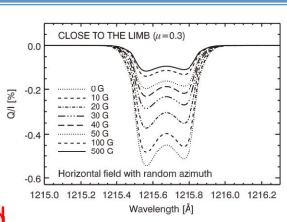
Chromospheric Lyman-Alpha SpectroPolarimeter (CLASP)

成影典之, 鹿野良平, 坂東貴政, 石川遼子, 久保雅仁, 勝川行雄, 石川真之介, 原弘久, 末松芳法, Giono Gabriel, 木挽俊彦,
鎌田有紀子, 都築俊宏 (国立天文台), 清水敏文, 坂尾太郎, 常田佐久 (ISAS/JAXA), 一本潔 (京都大学), 後藤基志 (核融合研),
Amy Winebarger, Ken Kobayashi (NASA/MSFC), Javier Trujillo Bueno (IAC), Frederic Auchere (IAS), CLASPチーム

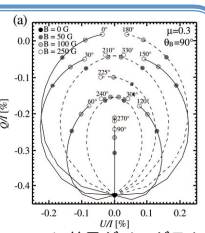
Science Target

It is expected that the linear polarization in Ly-alpha line varies depending on the photospheric magnetic fields (strength and direction) (by Atomic polarization + Hanle effect).

CLASP aims ① to detect the linear polarization in Ly-alpha line with 0.1 % accuracy, ② to detect the linear polarization caused by the Hanle effect, and ③ to infer the photospheric magnetic field.



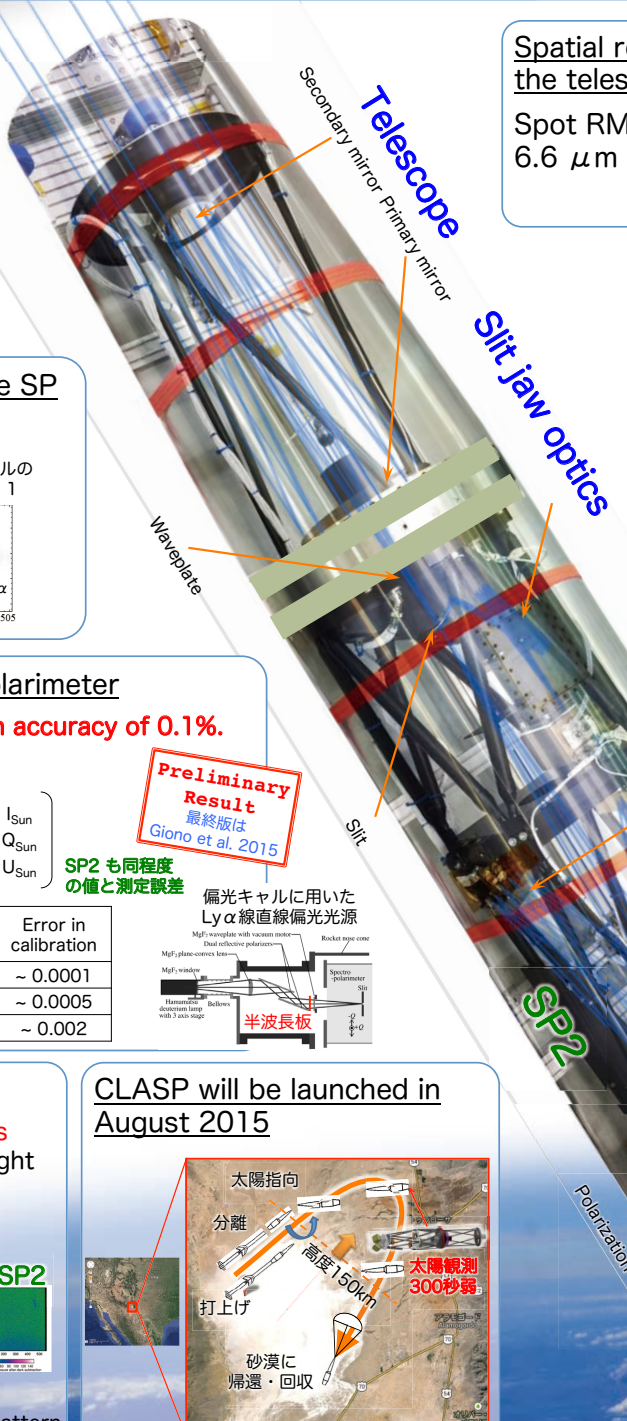
ハンレ効果で予測される Q/I スペクトル (Bueno et al. 2011)



ハンレ効果ダイアグラム (Ishikawa et al. 2014)

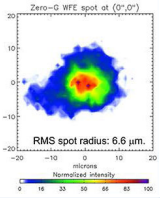
Novel optical design for the high precision polarization measurement (Narukage et al. 2015)

1. Simultaneous observation of orthogonal linear polarization with optically symmetric dual channel
2. High throughput optics with high reflectivity coating



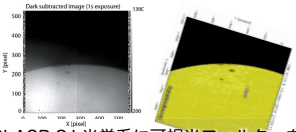
Spatial resolution of the telescope

Spot RMS radius
6.6 μm = 0.53 arcsec



Spatial resolution of SJ optics

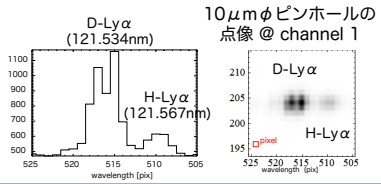
Spot RMS radius
22 μm = 1.76 arcsec



CLASP SJ 光学系に可視光フィルターを入れて撮像した黒点（望遠鏡のアライメント前の画像なので、ピントはボケている）

Wavelength resolution of the SP

σ ~ 0.003 nm



Calibration of the spectropolarimeter

CLASP achieves the polarization accuracy of 0.1%.

【Mueller matrix of CLASP SP1 】

$$\begin{pmatrix} I_{CLASP} \\ Q_{CLASP} \\ U_{CLASP} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0.0020 & 0.977 & 0.009 \\ -0.0004 & -0.009 & 0.977 \end{pmatrix} \begin{pmatrix} I_{Sun} \\ Q_{Sun} \\ U_{Sun} \end{pmatrix}$$

Preliminary Result
最終版は Giono et al. 2015

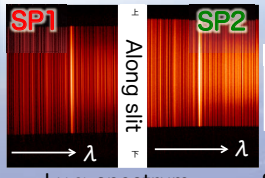
SP2 も同程度の値と測定誤差

	Torrance	Torrance in Mueller matrix	Error in calibration
Spurious pol.	0.01 %	0.0001	~ 0.0001
Scale error	2 %	0.02	~ 0.0005
Azimuth error	0.5 degree	0.01	~ 0.002

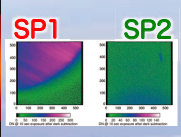
偏光キャルに用いた Lyα線直線偏光光源

Throughput & Stray light

CLASP can collect >10^7 photons during five minutes. The stray light is suppressed to < 0.3 % of expected Ly-alpha signal.



Lyα spectrum



Stray light pattern

CLASP will be launched in August 2015